

Takahide HOSOKAWA* : Studies on the life-form of vascular epiphytes and the spectrum of their life-forms.

細川隆英* : 着生植物の生活形及び着生植物生活形分析表に関する研究

The writer published the result of research-study on a life-form of vascular epiphyte in 1943** . As the addition to the one that the writer already described, he will modify some parts of it in the present paper as follows. The environmental chief factors in remarkable influence on vascular epiphytes may be those concerned with water and light. The life-forms considered to be attributed to the adaptation to the factor of water are pointed out distinctly, e. g. one of them is the succulent as xerophilous form in chief, and the other, as hygromorphous, the tuberosc character and filmy character of leaves of which mesophylls composed of 1-layer cells. The life-forms that may be attributed to the adaptation to the factor of light are those which succeed in enlarging the receivable area of light to get it sufficiently, e. g. the life-forms characterized with elongate internodes, sympodes in crowds and elongate monopode. While, there are some which are unnecessary to receive light sufficiently or adapted to a few light receivable, e. g. the life-forms characterized with shortened internodes or shortened axes. Therefore, considering those characters shown above, it seems to be appropriate to modify synoecologically as follows the system of vascular epiphytes already published by the writer in 1943**.

A modified system of life-form of vascular epiphytes.

I. Epiphyta typica.

Those species which grow on living plants throughout their life-time, without taking nourishment from the living tissues, are classified here as "Epiphyta typica". The life-forms in this group are divided into the following 2 subgroups, according to the compositions of their mesophylls in leaves.

A. Epiphyta unistrato-cellularis.

The mesophylls in leaves are composed of 1-layer cells, e. g. such epiphytes as filmy ferns. Fi

AA. Epiphyta multistrato-cellularis.

The mesophylls in any leaves composed of cells in many layers, e. g. most of vascular epiphytes.

B. Sempervirens.

In this group, the leaves of epiphytes are evergreen. According to the relative positions of the persistent axes capable of budding and substrata, and also to the correlative distances between substrata and the buds surviving in the unfavourable season, the writer divides into the follo-

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wings.

C. Altigemmi-epiphyta.

The active and dormant buds are borne on the apices of upright shoots generally far removed from substratum and rarely on the lower parts of shoots comparatively near to substratum. The persistent axes capable of budding are usually far apart from substrata.

1. Dendro-epiphyta.D

To this group belong those woody, upright and fruticose epiphytes with active or dormant buds borne on the shoots, far apart from substrata.

2. Monocauli-epiphyta.Mc

In this group, the stems are generally single and herbaceous. The active or dormant buds are borne generally on the apices or lateral sides of shoots apart from substrata, and rarely on the lower parts of shoots, near to substrata.

3. Scandens vel Volubilis.SV

The species of this group are either woody or herbaceous, either climbing up or twining around a support, and the active or dormant buds are borne on the shoots apart from substrata.

4. Succulenta.Se

The succulent epiphytes.

CC. Humiligemmi-epiphyta.

Those epiphytes which have the active or dormant or surviving buds situated very close to substrata. The possible budding parts as persistent axes or the persistent point of growth are very closely attached to substrata.

D. Mobiligemmi-epiphyta.

Either those travelling epiphytes which have creeping shoots close to substrata, or those which increase vegetatively by means of creeping-stolons on substrata.

5. Reptata remota.Rr

Those epiphytes which have the active or dormant buds situated on the creeping and rooting shoots or on stolons very close to substrata, and arrangement of whose buds is so dispersed that the upright shoots or leaves are far apart from one another.

6. Reptata densa.Rd

Those epiphytes which have the active or dormant buds situated on the creeping and rooting shoots very close to substrata, and the arrangement of whose buds is so crowded that the upright shoots or leaves are tufted together.

7. Succulenta.Se

The succulent epiphytes.

DD. Stabiligemmi-epiphyta.

The sedentary epiphytes without creeping shoots.

8. Caespitosa.C

The active or dormant buds are situated on the basal portion of the mother plant very close to substrata, and a shoot grows sometimes into an independent individual.

9. Fascicularis.F

Those epiphytes which have the rosette leaves without either upright or creeping shoots.

The active or dormant buds are situated comparatively close to substrata, but the plants do not increase vegetatively.

10. Succulenta.Se

The succulent epiphytes.

BB. Tempestivevirens.

The plant individual, excepting its surviving or dormant buds and roots, withers after the fruit-bearing season.

11. Radici-tuberosa.Rt

The individuals, excepting their surviving or dormant buds and newly born root-tubers buried under the carpet-like life-form of Bryophyta and humus near substrata, wither after the fruit-bearing season, like the Raunkiaer's "root-tuber geophytes".

II. Falsiepiphyta.

Either those species which grow on the living plants during some period of their life-time without taking nourishment from the living tissues or those species whose individuals grow occasionally on the living plants without taking nourishment from the living tissues, but under the ordinary circumstances generally exist as the terrestrial plants. The life-forms in this group are divided into the following three subgroups.

12. HemiepiphytaHe

Those species which grow on living plants, without taking nourishment from the living tissues, only in some period of their life-time, and grow in the other period of the same life-time as the terrestrial.

(a) Hemiepiphyta postera.

Those species which germinate at first on the ground and then climb up by means of their shoots the trunks of living trees like root-climbers and finally become epiphytes, withering away the lower parts of stems and roots.

(b) Hemiepiphyta praecoqua.

Those species which germinate on living plants and begin their life as epiphytes, but later develop their descending roots which grow to be false trunks, often strangling the host-trees, and finally turn to be the terrestrial plants.

13. Epiphyta occasionisO

Those species which are under ordinary circumstances terrestrial, but occasionally found on living plants, without taking nourishment from the living tissues, where they appear to thrive to maturity.

14. Epiphyta ephemeralisEph

Those species of vascular plants which germinate accidentally on living plants and fail to gain maturity in their epiphytic position and consequently die after attaining a size which demands more nutriment than the substrata can furnish.

The writer came to the conclusion that the all sorts of life-forms which belong to the physiognomic life-form system of vascular epiphytes, originated with the writer himself, are grouped themselves, from the result of statistical research to vertical distributions of vascular epiphytes in dense forests, in three main classes naturally, which represent how characteristic of sunny arid, intermediate or shady humid habitat is.

The result of the writer's research-study, as in the table in this paper and some others shows that the life-forms of characteristic of sunny arid habitat are **Rr, C, Se, Mc**, those of intermediate **Rd, F, SV, He, D**, and those of shady humid **Fi, Rt, O, Eph**. Though **Rr** is generally found on the sunny arid habitat as in tree-crowns, we sometimes see it existing on shady humid place of trunk-bases as **Fi** such as filmy ferns. Though the grade of shady humidity increases in dense forests in the order of crowns, crown-bases, trunks and trunk-bases, it is not always in this way on isolated trees in grassland or sparse woodland. In this case, trunks and trunk-bases are rather rich in sunny aridity, crowns rather shady, and crown-bases not so arid. Besides the degree of tree density in forests as above, the microclimatic conditions to vascular epiphytes in each habitat in forests

Table 1. The spectrum on life-form of vascular epiphytes of Palau. The table shows the percentage of species to each life-form in each habitat of each forest community. As Se is a life-form generalized with regard to succulency of all life-forms, it will be better to count up independently and show it in percentage which corresponds to the same species-number of the other life-forms. (Abbreviation: C=Crown. CB=Crown-base, T=Trunk, TB=Trunk-base)

Forest community		Orographic condition	Life-form Habitat	Fi	D	SV	Mc	Rr	Rd	C	F	Rt (Se)	He	O	Eph
Mangrove forests	<i>Sonneratia alba</i> Association	swamp	C CBT T TB					9 5 6	50 43 41	9 10 12	25 24 22	(33) (33) (24)	9 5	5	
	<i>Rhizophora mucronata</i> Association	swamp	CB C TB T	5 4 4				9 8 4	45 42 40	5 8 16	23 29 24	9 4 4	(32) (38) (28)	5 4	8
	<i>Bruguiera conjugata</i> Association	swamp	C CB T TB	4 3 6	4 3 6	4 3 6	6 7 6	35 27 47	18 15 18	35 27 18	6 12 7	(29) (18) (24)	4 3	4 7	
Swamp forests	<i>Calophyllum cholobtaches</i> Association	river-side swamp	C CB T TB	3 3 7	3 3 7		13 10 9	53 33 29	13 10 12	20 27 26	7 7 21	(49) (30) (32)	3 3	3	
	<i>Horsfieldia amklaal</i> Association	on flat swampy places	C CB T TB	8 13 55	3 3 3		11 5 6	31 26 22	11 13 18	26 26 19	17 15 22	(37) (28) (22)	3 3	3	
<i>Campnosperma brevipetiolata</i> - <i>Parinarium corymbosum</i> Association	<i>Campnosperma brevipetiolata</i> Consociation	on inclined planes and flat planes	C CB T TB	4 6 9 24	2 2 2		12 9 8	27 25 19	9 9 8	27 26 21	14 17 17	(33) (28) (21)	2 4 6	2 2 9	2 4
	<i>Parinarium corymbosum</i> Consociation	on ridges and inclined planes	C CB T TB	4 7 13	2 2 4		13 10 22	27 23 9	8 8 22	33 15 22	13 17 15	(38) (25) (24)	2 6 6	2 2 2	2 2
	<i>Gmelina palawensis</i> Consociation	on ridges	C CB T TB	3 17	3		22 14 12	56 36 18	11 21 11	11 14 17	11 21 33	(33) (29) (21)	3		
	<i>Manilkara udoido</i> Consociation	on ridges	C CB T TB	3 2 10 18	3 2 2		16 10 8 6	32 27 20 18	6 10 8 9	22 22 18 12	13 12 16 21	(35) (27) (16) (15)	3 5 8 9	5 5 2 6	5 2 4
<i>Sideroxylon glomeratum</i> Association	<i>Sideroxylon glomeratum</i> Consociation	on rocky ridges	C CB T TB	8 12	2		17 6 8 30	17 19 31 18	17 25 8 12	33 19 21 27	17 19 18 27	(50) (25) (26) (18)	6 6	6	
	<i>Sideroxylon glomeratum</i> - <i>Cleistanthus carolinianus</i> Consociation	on coral rock of littoral zone	C CB T TB		7 4 3 3	21 13 15 15	43 39 27 27		14 30 27 15	14 9 9 15	(43) (43) (42) (39)	6 6 3			
Grassland	<i>Dicranopteris dichotoma</i> - <i>Ischaemum intermedium</i> Association	on grassy billy planes	C CB T TB				84 67			16 33	(50) (67)				

are naturally different owing to the difference of such habitat as on inclined planes, ridges, flat planes, hollow places, river-sides, strands and maritime places. Whatever habitats from crowns to lower parts of trunk are remarkably sunny arid on ridges, strand and maritime places, but on hollow places the habitats from crown-bases to trunk-bases become considerably shady humid. So then, accordingly to the difference of every habitat in the forests, vertical distribution of the life-forms in vascular epiphytes also differs naturally.

The spectrum on life-form of vascular epiphytes is a table in which the species of epiphytes in some area are represented in conformity with any life-form, and it shows the apportionment of life-forms in percentage.

With the spectrum on life-form of vascular epiphytes, as compared the epiphyte societies with each other between forest communities, or among several^{*} vegetations, we are able to research and study more in detail together with the structures of some forest communities, and moreover, besides those, we may conjecture the general conditions of various forest communities with compared its macroclimatic or microclimatic conditions with each other. The writer became to consider that one of the ideal methods of synoecological research-study in forest communities is to get together the numerous spectra on life-form of vascular epiphytes from various forests, e. g. rain forests, raingreen forests, laurel-leaved forests, and sclerophyllous forests, of all parts of the world, and then the normal spectrum on life-form of vascular epiphytes will be made of these data, and what is studied comparatively on the spectrum on life-form of vascular epiphytes of any researching vegetation in relation to the normal spectrum as a standard is considered to be one of the suitable studying methods in plant sociology in warmer countries. But, to the writer's regret, as there have been no data to make up the normal spectrum, we are unable to show the normal spectrum on this paper.

Therefore, for the present, we can not do anything but to compare the spectra on life-form of vascular epiphytes in various vegetations with each other.